Miranda House

University of Delhi

Final Progress Report ofDU Star innovation Project MH – 01

Eureka! MyLab Developing Resources and Hands-on Science Activities and an Adaptation Accessible for Visually Impaired

Utilization Certificate
DU Star Innovation Project
Project code : MH 01
Financial Grant under DU Star Innovation

Project Title : Eureka ! My Lab Developing Resources and Hands-on Science Activities and an Adaptation Accessible for Visually Impaired

Project investigators : Dr Pratibha Jolly , Dr Mallika Verma , Dr Bani Roy.
Dr Janaki Subramanyan

College : Miranda House

Grant sanctioned		Rs.37,50,000/-			
Grant released		Rs.19,75,000/-			
S. No.	Budget Head	Amount utilized/Rs			
		2016-2017	2017-18	2018-19	Total
1	Manpower	-----	50,000.00	63,000.00	1,13,000.00
2	Equipment	2,13,413.00	-----	-----	2,13,413.00
3	Consumables	9,068.00	22,380.00	-----	31,448.00
4	Contingency	17,751.00	9,270.00	-----	27,021.00
Total amount Utilized		2,40,232.00	81,650.00	63,000.00	3,84,882.00

Certified that from the amount released Rs. 19,75,000/-, an amount of Rs. 3,84,882/- has been utilized for research. The unspent balance is Rs 15,90,118/-.

For Gupta Nandan & Associates
Chartered Accountants

Gupta Nandan & Associates * Chartered Accountants * New Delhi M. No. 086537

Pawan Kumar Gupta
(Proprietor)
Membership No. 086537
UDIN: 22086537AOAPKY3396
Date : 28/07/2022
Place : New Delhi

Janaki
(JANAKI SUBRAMANYAN)

PJRoy
(BANI ROY)

Mallika Verma
(MALLIKA VERMA)

Final Report

UNIVERSITY OF DELHI
STAR INNOVATION PROJECT 2016-18
FINAL REPORT

1. Project Code: MH 01

2. Project Title: Eureka! MyLab: Developing Resources and Hands-on Science Activities and an Adaptation Accessible for Visually Impaired

3. Name of College/Institution: Miranda House, University of Delhi

4. Principal Investigators (Name, Department, Email, Phone No.)

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5. Students in the Project

S. No.	Name	Course
1	Arti Konjengbam	B.Sc. Hons. Physics II Year
2	Deepali Shukla	B.Sc. Hons. Physics II Year
3	Deepika Negi	B.Sc. Hons. Physics II Year
4	Rashmi	B.Sc. Hons. Physics II Year
5	Sugandh Sirohi	B.Sc. Hons. Physics II Year
6	Sana Mehta	B.Sc. Hons. Chemistry II Year
7	Shalini Raghav	B.Sc. Hons. Chemistry II Year
8	Shubhangi Joshi	B.Sc. Hons. Chemistry II Year
9	Rashmi	B.Sc. Life Science II Year
10	Sonali Awasthi	B.Sc. Life Science II Year

Abstract

First, extensive research was conducted by the students involved in the innovation project to learn the level of exposure of the visually impaired students to the field of science and scientific experiments. Then, experiments and fun science activities of middle school level in Physics, Chemistry and Life Sciences were designed and compiled from existing sources for the visually impaired students and was later performed by them. The experiments and activities were successfully modified to satisfy their needs.

Introduction

Eureka! MyLab is a project under DU Star Innovation Project 2016-18. It is aimed at making science enjoyable and accessible to the visually impaired students.

Through various surveys and interviews, it was found that the visually impaired students study science till Class VIII in school curriculum. From Class IX onwards, majority of students prefer to take up non-science courses (arts/commerce). This is because arts and commerce do not have rigorous practicals like regular sciences. Also, such courses help them to learn soft skills which later in the future become of great importance to help them find employment opportunities.

As these students are not able to develop their science basics, it is found that the number of students pursuing graduate courses in sciences is decreasing in number. Identifying this gap between science and visually impaired students which starts from Class IX onwards, the project aimed to develop certain ways in which the visually impaired students can be at par with others in accessing science-related courses in future. We believe that if the students are encouraged and given the opportunity to develop their scientific aptitude, many remarkable innovations would be possible in the future.

Series of Activities

I. Various meetings were held to brainstorm the ways in which science can be made relatable to the visually impaired students. For this, it was necessary to get an insight into the difficulties faced by the visually impaired students. So an interview session was arranged with Mr Kaish, a Miranda House staff member attached to the Amba Dalmia Resource Centre for the Visually Impaired. He said that the visually impaired students are given computer-operating training so that they are able to secure employment opportunities in future. For this, JAWS (Job Access with Speech) software is used, which converts written data on computer screen to audio signals which are easily comprehended by the students. Also, he demonstrated various mathematical instruments like abacus, protractor, ruler, etc., especially designed for the visually impaired students.

Key Findings

- The students are able to operate the computer quite easily by regular training. Thus, if given an opportunity and proper training, these students will also be able to handle the apparatus in labs. As we know, visually challenged-non-friendly labs are the main reason why the students opt out of science courses, thus this hindrance can be solved partially over time.

- The students are able to easily use JAWS Software. Thus, if labs incorporate it, the students will be able to read and comprehend the procedures for carrying out any experiment.

- The especially designed geometry equipment can easily be used to draw tactile graphs to find the outcomes of the experiment. The students are already efficient in using MS Excel which can also aid in depicting experimental conclusions graphically.

II. Next, in order to get better insight into the level of knowledge visually impaired students possess for the Sciences, the project team visited The Blind Relief Association, Lodhi Road. The team wished to come up with new ideas with which the visually challenged can get exposed to the Sciences. The team talked to some of the teachers there and got to know that the students are taught Science only till the primary level, i.e., Class VIII. The students do not get to study Science further due to the lack of availability of technology that could help them understand the scientific concepts.

Observations of the Team at the Blind Relief Association

The team observed closely how the visually challenged go about everything and realized that they are well acquainted with the jobs they are assigned to. The visually impaired students are able to perform many tasks with great efficiency. Students were able to classify different advertisements on Quickr using the JAWS software. A few of them work with call centers with the help of special computer software. They use special voice sensors while learning to work with MS Office.

The way they are tutored has helped them achieve perfection in many fields such as making candles, paper bags, clay showpieces, letters, diaries, lamps, etc. They regularly work on producing many incredible festive shopping items for the annual Diwali Mela Sale. The team also observed the models that help them understand Science like raised readings on a Measuring Cylinder and thread attached to the World Map etc. They are introduced to the fauna and flora by using different models of birds, animals and plants.

Interactions of the Team at the Blind Relief Association

(i) Mr. David: He familiarized the team with the institution.
(ii) Ms. Rashmi Kakkar: She explained about the working of the call centre in which many visually impaired students work.
(iii) Ms. Latika, Mr. Ramveer, Ms. Ritika: II Year B.Ed. students who are getting trained to teach visually impaired students whom the team can contact in the near future to get more information.
(iv) Mr. Narendra Jha: He gave the team a few ideas about how Science is being taught to middle school students and also shared information about the tools available to students in other countries that he had visited.
The team also interacted with a few visually impaired trainees of the vocational centre.

Learnings at the Blind Relief Association

The visit to the Blind Relief Association made the project team realize that the visually impaired students are able to perform tasks assigned to them efficiently. For example, they came to know that certain students are employed by Quickr. These students with the help of JAWS software classify the advertisements on Quickr as genuine or fake. They call the customers and verify their ads and make a database on the computer which is sent to the

company. The team was happy to observe that the students are able to perform the task as efficiently as others who are not visually challenged. The team also visited the computer lab where the students were taught the basics of computer like MS Office. With practice, they become familiar with the usage of computer and technology in day-to-day life. The team also observed a number of visually impaired people who had been trained in different tasks like making of candles, paper bags, clay showpieces and also in stitching cloth bags. They use their skills to produce items in bulk that can be put up for Diwali Mela Sale. The team realized that the students are able to perform tasks efficiently through training. Thus the students can be encouraged to explore the science stream through exposure to the flavor of science experiments with hands-on tasks combined with technological assistance.

The following visuals display how visually impaired people have mastered their respective jobs and are doing it with full ease.

Thus, the conclusion was that with the help of teachers and a bit of assistance, these students can pursue science with ease and can become proficient.

III. In order to get in-depth knowledge about Science taught to the visually impaired students, the team decided to visit two schools: Janta Adarsh Andh Vidyalaya (JDAV), Sadhir Nagar, New Delhi and National Association for Blind (NAB), R. K. Puram, New Delhi. JDAV is a co-ed school teaching science till VIII standard and NAB is a co-ed school teaching science till X standard. In both the schools, the team interacted with the Science teachers and got to know about the practicals that are being performed by the students during their Science course.

The teachers showed us several instruments through which measurements can be made, paper cutting tools, and various tactile models explaining digestive system, respiratory system, crop distribution in India, etc.

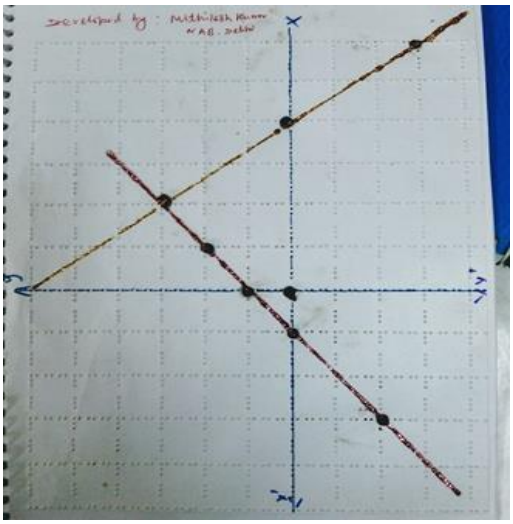
The team got an opportunity to go through the Science and Mathematics textbooks of Class X especially designed for the visually impaired students. It was the regular NCERT textbook but with tactile diagrams to explain geometry and other things.

Key Findings

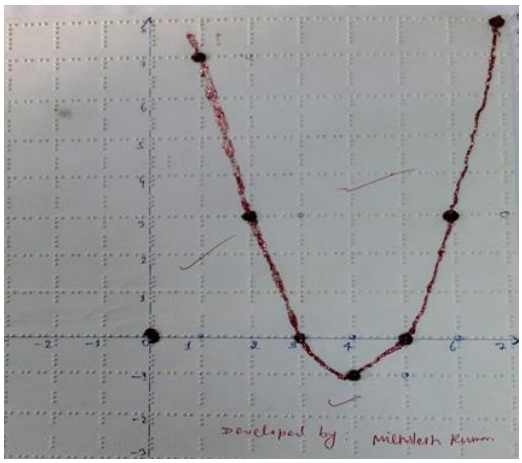
- The measuring instruments used by the students have raised markings which make it easy for them to take the measurements. So, since the students are already familiar with simple concepts of measurement, they are able to use these techniques in the labs. As can be seen in the photographs below, the measuring instruments set includes a scale, a set square and a protractor, all with raised markings, a tactile marking making set through which various diagrams can be made.

- The students of X standard are well aware of the way and techniques of making graphs which later will be very helpful for them in the calculations which need to be done for various experiments. Some of the graphs are as illustrated below:

- Straight line curve:

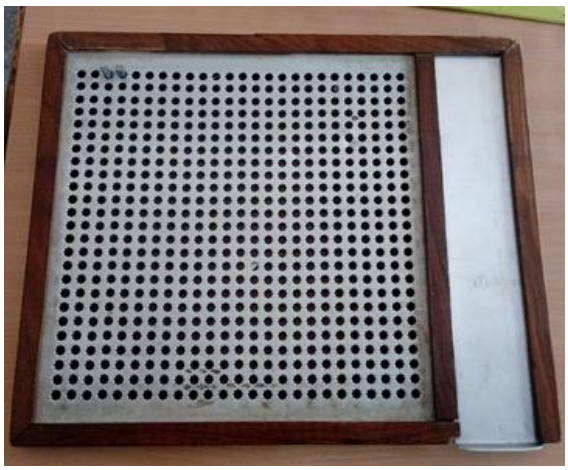


- Parabolic Curve:



- Students get to know about the respiratory system, digestive system and other concepts via tactile models which can be used further as well to explain various systems and electric circuits. Also, with the availability of the techniques to make different tactile shapes which students are well aware of they can make their own circuit diagrams as well.

- Students use their own ways of calculation by using a board and a few pins that fit into those boards. For example, a student has to add two digits say 3 and 4. The pins used for calculations have 9 different sides which tell you about the different numbers it is showing. So, to add 3 and 4, we would use 3 pins (2 for digits and 1 for the symbol); the addition symbol is shown by inverted 3 symbol. And hence they could add the numbers by using this method (this is a mathematical representation of a simple calculation). Similarly, many rigorous calculations can be shown by this method. The board used for calculating is shown below:



IV. The gap between visually impaired students and Science starts from Class VIII, as it was found. The team made a list of experiments covering topics like Sound, Electricity, Magnetism and Electromagnetism. Instead of straightaway starting with the main experiments, the team designed a series of simple science activities that arouses the students' interest in science experiments. Care was also taken not to include the experiments that were very technical or hazardous in nature.

Fun Activities

1. Teach them why small units of measurement are required by making them measure different objects by first using their palm then their fingers, etc. and give them detailed description of units and measurement.
2. Teach them how to measure length of a curved path by a string.
3. Teach them about different motions by introducing activities: circular, rectilinear, periodic, etc.
4. Place a box on the table. Ask two people to push it in one direction only. Follow the same activity with force in reverse direction.

Result: Force is a vector which gets added in same direction and subtracted in opposite direction

5. Apply force on a ball of wet clay.

Result: With forces applied in different directions, the shape of clay changes. This implies force can change the dimension of an object.

6. Push a wooden box from one end of the table to another. Repeat the activity with a toy car.

Result: Friction force increases with increase in surface area of contact.

PHYSICS EXPERIMENTS

Experiment 1
Aim: To make a simple electromagnet.

Requirements: A large iron nail (about 3 inches), thin coated copper wire, a fresh electric cell, some paper clips.

Procedure:

1. Leave about 8 inches of wire loose at one end and wrap most of the rest of the wire around the nail. Try not to overlap the wires.
2. Cut the wire (if needed) so that there is about another 8 inches loose at the other end too.
3. Remove about an inch of the plastic coating from both ends of the wire and attach the one wire to one end of the cell and the other wire to the other end of the cell.
4. Now, you have an electromagnet. Put the point of the nail near a few paper clips.

Observations: The electromagnet attracts the paper clips.

Note: Making an electromagnet uses up the cell somewhat quickly which is why the battery may get warm, so disconnect the wires when you are done exploring.

Conclusion: Most magnets like the ones on many refrigerators cannot be turned off, they are called permanent magnets. Magnets like the one made in this experiment that can be turned on and off are called electromagnets. They run on electricity and are only magnetic when the electricity is flowing. The electricity flowing through the wire arranges the molecules in the nail so that they are attracted to certain metals. Never get the wires of the electromagnet near a household outlet. Be safe and have fun.

Experiment 2
Aim: To make an electric bell.

Requirements: An electromagnet, a gong bell, a switch

Procedure:
1. Connect one end of the switch with the power supply of the electromagnet and the other end to the arm of the gong.
2. Push the switch.

Observation: The arm hits the gong making it ring.

Conclusion: When you push the switch, electric current flows to the electromagnet. The electromagnet attracts the arm, which then hits the gong, making it ring.

Experiment 3
Aim: To investigate whether sound travels better through a solid or a gas.

Requirements: One friend, one table

Procedure:
1. Sit opposite your friend.
2. Knock on the table.
3. Listen to how loud the sound is.
4. Ask your friend to place their ear against the surface of the table.
5. Knock on the table again.
6. Ask your friend to describe how loud the sound is through the table.

Observations: When you listen to the knocking sound through the table, it is much louder.

Conclusions: Sound travels better through a solid (table), than through a gas (air).

Experiment 4
Aim: To examine how the larynx or voice box vibrates as we speak.

Requirements: Yourself, your hand.

Procedure:
1. Place your hand firmly midway on your throat.
2. Say 'aghhhh!' for as long as you can.

Results: You can feel your throat vibrating.

Conclusion: Sound is produced through vibrations.

Experiment 5
Aim: To examine (hear and feel) sound vibrations.

Requirements: A partner, a balloon.

Procedure:
1. Blow up the balloon.
2. Hold it against your ear.
3. Ask your partner to press their lips against the balloon and speak.
4. Repeat steps 3 and 4 but this time you should speak and your friend should listen.

Result: You can hear the vibrations through the balloon and you can feel them. You can feel your own voice through your lips as the balloon's skin vibrates against them.

Conclusions: Sound is created when an object moves and the air around it vibrates creating sound waves.

Experiment 6
Aim: Sound needs a medium to travel.

Requirements: Electric bell and glass jar.

Procedure:
1. Take an electric bell and an airtight glass bell jar.
2. Suspend the electric bell inside the bell jar.
3. Connect the bell jar to a vacuum pump. If you press the switch, you will be able to hear the bell.
4. Now start the vacuum pump. When the air inside the jar is pumped out gradually, the sound becomes fainter although the same current is passing through the bell. After some time, when less air is left inside the bell jar, you will hear a very feeble sound.

Conclusion: Sound cannot travel in vacuum.

Experiment 7
Aim: To demonstrate reflection of sound.

Requirements: Paper pipes, table, clock.

Procedure:
1. Take two identical pipes. You can make the pipes using chart paper. The length of the pipes should be sufficiently long.
2. Arrange them on a table near a wall.
3. Keep a clock near the open end of one of the pipes and try to hear the sound of the clock through the other pipe.
4. Adjust the position of the pipes so that you can best hear the sound of the clock.
5. Now, measure the angles of incidence and reflection and see the relationship between the angles.
6. Lift the pipe on the right vertically to a small height and observe what happens.

Conclusion: Sound obeys laws of reflection.

Experiment 8
Aim: To investigate the relationship between electricity and magnetism.

Requirements: Copper wire, electric circuit, compass.

Procedure:
1. Take a piece of straight, thick copper wire and place it between the points X and Y in an electric circuit. The wire XY is kept perpendicular to the plane of the paper.
2. Horizontally place a small compass near this copper wire. Trace the position of its needle.
3. Pass the current through the circuit by inserting the key into the plug. Observe the change in the position of the compass needle.

Observations: The needle is seen to be deflected.

Conclusion: It means that the electric current through the copper wire has produced a magnetic effect. Thus, we can say that electricity and magnetism are linked to each other.

Experiment 9
Aim: To investigate the concept of magnetic field lines.

Requirements: White paper, drawing board, bar magnet, compass, iron filings, salt sprinkler.

Procedure:
1. Fix a sheet of white paper on a drawing board using some adhesive material.
2. Place a bar magnet in the center of it.
3. Sprinkle some iron filings uniformly around the bar magnet A salt-sprinkler may be used for this purpose.
4. Now tap the board gently.

Observations: The iron filings arrange themselves in a pattern.

Conclusions: The magnet exerts its influence in the region surrounding it. Therefore, the iron filings experience a force. The force thus exerted makes iron filings arrange themselves in a pattern. The region surrounding a magnet, in which the force of the magnet can be detected, is said to have a magnetic field. The lines along which the iron filings align themselves represent magnetic field lines.

Experiment 10
Aim: To draw the magnetic field lines of a bar magnet.

Requirements: Compass, bar magnet.

Procedure:
1. Take a small compass and a bar magnet.
2. Place the magnet on a sheet of white paper fixed on a drawing board, using some adhesive material.
3. Mark the boundary of the magnet.

4. Place the compass near the north pole of the magnet. The south pole of the needle points towards the north pole of the magnet. The north pole of the compass is directed away from the north pole of the magnet.
5. Mark the position of two ends of the needle.
6. Now move the needle to a new position such that its south pole occupies the position previously occupied by its north pole.
7. In this way, proceed step by step till you reach the south pole of the magnet.
8. Join the points marked on the paper by a smooth curve. This curve represents a field line.
9. Repeat the above procedure and draw as many lines as you can. These lines represent the magnetic field around the magnet. These are known as magnetic field lines.
10. Observe the deflection in the compass needle as you move it along a field line.

Conclusion: The deflection increases as the needle is moved towards the poles. Magnetic field is an entity that has both direction and magnitude. The direction of the magnetic field is taken to be the direction in which a north pole of the compass needle moves inside it. Therefore, it is taken by convention that the field lines emerge from north pole and merge at the south pole. Inside the magnet, the direction of field lines is from its south pole to its north pole. Thus, the magnetic field lines are closed curves. The relative strength of the magnetic field is shown by the degree of closeness of the field lines. The field is stronger, that is, the force acting on the pole of another magnet placed is greater where the field lines are crowded. No two field lines are found to cross each other. If they did, it would mean that at the point of intersection, the compass needle would point towards two directions, which is not possible.

Experiment 11
Aim: To show conduction of heat

Requirements: Iron rod, ice, candle, match stick, and stand.

Procedure:
1. Clamp an iron rod having ice pieces stuck to it on a stand.
2. Keep your hand under one end of the rod.
3. Bring a candle at the other end.
4. You will feel the melted ice falling on your hand.

Conclusion: Heat travels from one end of the iron rod to the other.

Experiment 12
Aim: To study the relation between pressure and height

Requirements: Hollow glass tube, balloon

Procedure:
1. Take a glass tube and attach a rubber balloon at its lower end.
2. Fill the tube with water gradually up to different heights.

Result: It is observed that more the height of water column, more is the bulging of the balloon. This proves that height of water column is directly proportional to pressure.

CHEMISTRY EXPERIMENTS

Experiment 1

Aim: To demonstrate the reaction of zinc with hydrochloric acid and inflation of balloon due to hydrogen gas released

Requirements: Zinc pieces, hydrochloric acid, filtration tube (boiling tube with side arm), rubber stopper, small funnel, piece of rubber tubing, rubber balloon, piece of string

Procedure

1. Attach a piece of rubber tubing to the side arm of a filtration tube (boiling tube with a side arm).
2. Attach a balloon to rubber tube attached to arm of flask.
3. Pour some dilute hydrochloric acid into the flask using a funnel.
4. Remove funnel, add some zinc pieces into the tube and quickly place a rubber stopper in the mouth of the tube, holding on to both the stopper and the balloon as it begins to inflate.
5. After the reaction has ceased, tie the balloon with a piece of string.
6. Release the balloon – it will float upwards.

Conclusion

Hydrogen gas is released in the reaction of zinc with hydrochloric acid. Hydrogen is lighter than air as shown by the upward motion of the balloon when released

Experiment 2

A. Aim: To separate the mixture of sand and iron filings using a magnet

Requirements: Sand, iron filings, two petri dishes, bar magnet,

Procedure

1. Take the mixture of sand and iron filings in a dish.
2. Carefully take a magnet close to it and hold over the mixture for a minute, rotating all around the dish.
3. Feel the iron filings sticking to the magnet.
4. Use your fingers to pull the iron filings off the magnet into another container and quickly take the magnet away so that they do not stick to the magnet again.
5. Repeat once more to check if any iron filings are left in the first dish.

B. Aim: To separate the mixture of sand and salt using water

Requirements: Sand, salt, water, filter paper, funnel, two beakers, glass rod, tripod stand, wire gauze, Bunsen burner

Procedure

1. Take the mixture of sand and salt in a beaker.
2. Add water and stir with a glass rod.
3. Filter the solution through the filter paper placed in the funnel into another beaker.
4. Evaporate the salt solution on a wire gauze over a tripod stand using a Bunsen burner.

Conclusion
Mixtures can be separated using the special properties of any of the components e.g., iron is attracted to a magnet whereas sand is not; salt is soluble in water while sand is not.

Experiment 3
Aim: To identify substances by smell

Requirements: Rectified spirit, nail polish, iodex balm, rose water, camphor, sandalwood oil, clove oil, coconut oil, mustard oil, Vicks Vaporub, grated ginger, grated garlic, grated onion, petri dishes

Procedure
1. Pour or place a small amount of each of the materials into petri dishes.
2. Carefully smell the materials without taking too deep a breath from close quarters.
3. Note down the smell type as 'pungent', 'sweet', 'fruity' etc.

Conclusion
Many substances can be identified by their smell.

Experiment 4
Aim: To determine whether a substance is lighter or heavier than water

Requirements: Beaker of water, piece of paper, bark cork, iron nail, piece of wood, small pebble

Procedure
1. Carefully place a small amount of each of the materials onto the surface of water contained in the beaker.
2. Feel with your fingers whether the material has remained on the surface or gone to the bottom.
3. Note down your observation.

Conclusion
Some materials are lighter than water and float on the surface, e.g., paper, bark cork, piece of wood. Other materials are heavier than water and sink to the bottom when placed in the water, e.g., iron nail, pebble.

BIOLOGY/LIFE SCIENCE EXPERIMENTS

Experiment 1
Aim: To blow up a balloon with yeast.
Requirements: Plastic bottle, yeast packet, sugar, balloon.
Procedure:
1. Fill a small plastic bottle with about one inch of warm water.
2. Add the entire yeast packet and gently swirl the bottle a few seconds.
3. Add some sugar to the bottle and swirl it around to dissolve the sugar.
4. Blow up the balloon a few times to stretch it out and then fix the neck of the balloon over the neck of the bottle.
5. Let the bottle sit in a warm place for about 20 minutes.
6. If all goes well the balloon will begin to inflate.
7. As the yeast eats the sugar, it releases a gas called carbon dioxide (CO_2).

8. The sugar is used as a substrate during respiration and CO_2 is released.
9. The gas fills the bottle and then fills the balloon as more gas is released.

Experiment 2
Aim: To find the probability of a baby's gender.
Requirements: Permanent marker, two paper cups, two types of beans: *chole* and *rajma.*
Procedure:
1. Mark one cup "ova" and put *chole* in that cup.
2. Mark the other cup "sperm" and put equal numbers of *chole* and *rajma* in it. Mix the two types of seeds.
3. Make a table with different options two *chole* (for a girl), one *chole* and one *rajma* (for a boy).
4. Look away and choose one bean from each cup. Keep the pairs of beans thus picked separately on two sides. The left side can be for two *chole* beans and the right side for one *chole* bean and one *rajma* bean.
5. Do this 30 times. How many boys and girls did you get?
6. The role of X and Y chromosomes in determining the gender of a baby can be explained.

Experiment 3
Aim: To listen to heartbeats without a stethoscope.
Requirements: Empty paper towel tubes.
Procedure:
1. One student places the end of a paper towel tube to his/her ear and the other end of the tube to a friend's chest.
2. Once he/she hears the heartbeat, have the friend jump up and down 15 times. Listen to heartbeat again to see if there is any change.
3. The number of heartbeats per minute can be recorded when the friend is resting and after jumping. The difference in the values obtained can be given a suitable explanation.

Experiment 4
Aim: To separate healthy seeds from unhealthy ones.
Requirements: Beaker, water, wheat grains.
Procedure:
1. Take a beaker. Half fill it with water. Put some wheat grains in it. Leave the beaker for some time. Observe the grains, see if the grains float or sink in the water.
2. You will find that damaged grains float on surface of water because they are lighter, whereas healthy grains settle down at the bottom of the beaker. Remove the floating seeds manually by hand.
3. This exercise can be performed using *chole* beans as well.

Experiment 5
Aim: To compare the water absorbing capacity of natural and synthetic fibers.
Requirements: Cotton cloth, nylon cloth, two mugs, water.
Procedure:
1. Take two pieces of cloth of equal size: one made of cotton and the other of nylon.
2. Now take two mugs having equal amounts of water.
3. Drench each piece of cloth separately in the two mugs.
4. After five minutes, take out the cloth pieces and let the water drain into the mug in which the cotton or nylon cloth piece was kept. Observe the water left in the mugs.

5. You will find that less water is left in the mug in which the cotton cloth was drenched.
6. Thus, cotton absorbs more water than nylon.

Experiment 6
Aim: To differentiate round seeds from wrinkled seeds.
Requirements: Two Petri dishes, round pea seeds, wrinkled pea seeds.
Procedure:

1. Take the round and wrinkled seeds in two separate Petri dishes.
2. Now make the students touch those seeds so as to recognize the texture of the different seeds.
3. Explain to them about Mendelian inheritance, round seed being under the control of the dominant allele and wrinkled seed under the control of the recessive allele. The procedure followed in experiment 2 can be used to explain the role of alleles of a gene in controlling a trait.

Experiment 7
Aim: Identification of different types of flowers by their fragrance.
Requirements: Easily available flowers, e.g., rose *(gulab),* marigold *(gainda),* tuberose *(rajnigandha),* sacred basil *(tulsi).*
Procedure:

1. Ask the students to smell the flowers and try to recognize them by the fragrance of the flower.
2. Discuss the basic characteristics of flowers, pollination and pollinating agents.

Experiment 8
Aim: To demonstrate the process of osmosis using raisins.
Requirements: Raisins**,** water, very concentrated and less concentrated sugar solutions**,** beakers labelled A, B and C.
Procedure:

1. Took three beakers and filled them with water (A), very concentrated sugar solution (B), and less concentrated sugar solution (C).
2. Place four raisins in each beaker. Let the raisins be in the beaker for two hours.
3. Now take out the raisins from the beakers and observe them.
4. Ask the students to feel the raisins with their hands.
5. The raisins in beaker A would have swelled up, those in beaker B would have shrunken, whereas those in C would not have changed much.
6. Explain to them about the process of osmosis and its significance.

V. After performing the experiments, it was time to test whether the data can be read by JAWS software. The team performed the simple experiments and read the data using JAWS software. It worked.
VI. To create tactile diagrams which can be understood by the students, 3D pen was used e.g., to create circuits.
VII. Visit to the India International Centre to attend a seminar which outlined various new technologies developed.

A summary of the visit of mentors and student volunteers is given below.

Seminar on *"Sugamya Pustakalaya: Enabling Libraries to Meet the Needs of Persons Who Cannot Read Normal Print"*
Date: 6 January 2017
Time: 6:00 pm to 7:00 pm

The following members of the Star Innovation Project Eureka! MyLab attended the event:
Project Investigator Dr. Janaki Subramanyan, Department of Botany
Student researchers
1) Rashmi (Life Science)
2) Sonali Awasthi (Life Science)
3) Sugandh Sirohi (Physics)

Mr. Kaish, Assistant at the Amba Dalmia Centre, two faculty members from the Department of Sociology, Ms. Anasuya and Mr. Rajeev Mishra, and 10 visually impaired students of Miranda House also attended the event.

Background
The aim of the DU Star Innovation Project Eureka! MyLab is to try and develop techniques for the Visually Impaired students to be exposed to the Science stream. The idea is to show them the joy of science and finally make a science laboratory for them.

Summary of the proceedings
Talks were given by the following esteemed speakers:
1. Dr. Ramesh Gaur, University Librarian, Jawaharlal Nehru University (JNU)
2. Dr. Narender Kumar, Deputy Librarian, I/C Braille Library, University of Delhi
3. Shri Dipendra Manocha, Director of the Regional Resource Centre (New Delhi), DAISY for all.

Talk on Services and Facilities extended to visually impaired students: University of Delhi by Dr. Narender Kumar
According to Census 2011, 2.68 crore people are Divyang (disabled), out of which 18.8% were visually impaired. According to the the 'Copyright Amendment Act' of 2012 there is no need of taking permission to convert books into Braille and e-format. In 1972, by the great efforts of Delhi University, a library was established to provide reading material in Braille script and reading services to visually challenged students. In 2006, Delhi University, established the Equal Opportunity Cell (EOC). Colleges also established EOC, in which visually impaired students are provided with study equipment such as laptop with relevant software, Braille readers, writers, recording equipment etc. Special orientation, counselling sessions, sports meet and capacity building classes are also organised. The services provided by the Braille library include Online Access to Audio/E-text, Braille print, E-text of the books on CDs free of cost, and a computer lab with 18 computers. Software used by I/C Braille Library are:
1. Audio recording - DAISY Forum-OBI3.9
2. E-text to Braille out - DUXBURY
3. Screen reading software - English (JAWS, NBDA), Hindi (SAFA, LEKHA, Sangita)
4. OCR software - Hindi (INDSENZ)

Delhi University shows its library extension by taking membership of DAISY Forum of India and Sugamya Pustkalaya. But still visually impaired students are facing some challenges such as lack of competent staff, attitudinal challenges, awareness about the facilities, frequent changes in technology, and the University is continuously making efforts to cope with these challenges.

Talk by Dr. Ramesh Gaur, Librarian, JNU

Dr. Gaur has been working in JNU for a very long time and has given his immense contribution and dedicated efforts for improving the facilities for the visually impaired people there and assisting them to the utmost.

There is a special cell in JNU library for the visually impaired named "HELLEN KELLER UNIT". The computers and other systems have special software, like

1. JAWS (scripting language)
2. DUXBURY (DBT) for Braille transcription
3. Digital Voice Recorder (DAISY FORUM), Braille printer and scanners
4. Classroom lectures are recorded
5. SUGAMYA PUSTAKALAYA - is an online accessible book library which has proved a boon for visually impaired
6. SAKSHAM is an institution which employs people who themselves are blind and impart knowledge to others

Talk by Shri Dipendra Manocha

Shri Dipendra Manocha who himself is visually impaired spoke about DAISY Forum of India (DFI). The goal of DFI for next 3 years is

a. Online library with accessible digital copies of 500,000 books including:
    i. All school and university textbooks
    ii. 100 newspapers and periodicals
    iii. Books for all age groups
b. Reaching out to a million users with print reading disabilities with KIT, CONTENT and CONFIDENCE.

Some activities undertaken by them to achieve their goals are

1. Several accessible digital content creation projects
2. 20,000 DAISY players or smart phones provided free of cost to economically challenged persons with vision impairment.

Role of libraries and NGOs

1. Set up accessible book section
2. Register users to Sugamya Pustakalaya
3. Provide training and support to end users
4. Convert the book in a format required by end user

Development in the Field of Science

When asked about the development in the field of science Shri Dipendra Manocha replied that they are developing science books with tactile diagrams to help visually impaired students understand better. He also told the audience about one of his students Kartik who had science in graduation and is now studying in Stanford. Kartik used to do his lab work with the help of an assistant.

Learning from the Seminar

It was an educative seminar which informed the audience about a lot of facilities available for visually impaired students. The project team felt motivated to contribute towards the development of more facilities, especially in the field of science.

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VIII. Organization of Hands-on Activity for visually impaired students

On 19 February 2018, the student researchers of Eureka! MyLab performed various experiments with six visually challenged students of Miranda House in the Chemistry laboratory of the college. A series of Physics, Chemistry and Biology experiments were performed with these students to help them understand basic sciences a bit more deeply. These experiments were especially designed for the visually impaired students and were performed with utmost care. The project volunteers (in groups of two) first performed the experiment, explaining in detail the importance of a particular experiment, its relevance in our daily lives and the complete science behind it. The specially abled students were then given a chance to do the same, under supervision of the student volunteers. The workshop was a success as the visually impaired students seemed to enjoy performing the experiments and getting to know the magic of Science, an experience they had for the first time. The photographs below illustrate this amply.

PHYSICS EXPERIMENTS

1. To Explain How Sound is Produced and to Show Reflection of Sound.

2. To Explain Elasticity and Distinguish Between Elastic and Non-Elastic Materials.

3. To Explain Properties of Magnet and Distinguish Between Magnetic and Non-Magnetic materials.

4. To Explain How Current Flows and to Distinguish Between Conducting and

Non-Conducting Materials.

CHEMISTRY EXPERIMENTS

1. Reaction of Zinc with Hydrochloric Acid and Inflation of Balloon due to Hydrogen Gas Released

2. Separation of Sand and Iron Filings Using a Magnet (Proving that a Magnet Attracts Iron)

BIOLOGY/LIFE SCIENCE EXPERIMENTS

1. Illustration of Digestive System Using a Tactile Model.

2. To Explain Mendelian Inheritance and the Role of X and Y Chromosomes in Determining the Gender of a Baby Using Different Types of Seeds.

Conclusion: At the end of the workshop, the visually impaired students who participated told the project team that they learned a lot and had a great time. They said that the workshop was fun and educative at the same time, and that they would love to be part of more such workshops.

Outcome of the project

The project was a learning experience for the entire team. The interaction with the visually challenged school and college students was rewarding because the student researchers and faculty mentors realized for the first time that the differently abled were highly motivated to perform well and efficient at tasks allotted to them. Certain misconceptions and wrong terminology were cleared up and the project team was motivated to find ways for integrated science learning. Some of the science learning tools already in common use for the visually impaired in advanced countries are not yet available in India so the students needed to find circuitous routes to introduce science concepts to the differently abled. This sharpened their improvisation skills and forced them to do some innovative thinking. The awareness gained by the students who have been part of the team will make them socially conscious, responsible individuals always ready to help with integrated learning.

Miranda House
University of Delhi

Certificate of Originality

This is to certify that the Project Investigators and the students of Innovation Project having Project code MH-01 and title *Eureka! MyLab: Developing Resources and Hands-on Science Activities and an Adaptation Accessible for Visually Impaired* of Miranda House College/institute have carried out original research work submitted as Final Report to the University of Delhi. The work and the report are original. Any plagiarism dispute arising out of the project will be our responsibility.

Project Investigators

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(JANAKI SUBRAMANYAN)

BRoy
(BANI ROY)

Mallika Verma
(MALLIKA VERMA)